# MG2639_V3 Module Hardware Design User Manual

## Version：V1.2

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# Version update description

| Product version | Document version | Document No. | Document update descriptions | Date of release |
|---|---|---|---|---|
| MG2639_V3 | V1.0 | | Released for the first time | 2013-9-6 |
| MG2639_V3 | V1.1 | | Add Refer to GPS design 4.6 | 2013-11-08 |
| MG2639_V3 | V1.2 | | 1) the module's thickness has changed from 2.68mm to 3.0mm.<br>2) delete 'GPS supports passive antenna only' in Section 4.6.<br>3) Add Section 4.7 'Connection Method of GPS Active Antenna'. | 2014-1-4 |

# Writer

| Document version | Date | Written by | Checked by | Approved by |
|---|---|---|---|---|
| 1.0 | 2012-8-23 | Cai Zongfei | | |
| 1.1 | 2013-11-08 | Cai Zongfei | | |
| 1.2 | 2014-1-4 | Zhao Xiaolin | | |

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# Preface

## Summary

This document describes MG2639_V3 module's product principle diagram, module's PINs, hardware interface and module's structure, and instructs the users to perform hardware design of modules, and quickly and conveniently design different kinds of wireless terminals on the basis of this module.

## Target Readers

This document mainly applies to the following engineers:

- System designing engineers
- Mechanical engineers
- Hardware engineers
- Software engineers
- Test engineers

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# 1 General description of module

Developed by ZTE Corporation, MG2639_V3 is a kind of GSM850/EGSM900/DCS1800/ PCS1900 industrial module with the independent GPS function, which can be built in the Set-Top-Box, vehicle-mounted terminals through a 60-PIN stamp-hole interface, and it allows users to send/receive Emails, browse the web pages and download at high speed anywhere and anytime.

In a place where the GSM network is covered, users can get access to the Internet any time, send/receive SMS and dial/answer voice calls, etc. In the field of mobile data communication, it provides a highly free and convenient solution to users and truly realizes the dream of mobile office.

This chapter mainly provides a general description of the module, including basic functions and logic block diagram.

## 1.1 Introduction of module's functions

See the functions of MG2639_V3 module in table 1-1:

Table 1-1 Module's functions

| Parameters | MG2639_V3 |
|---|---|
| General Features | |
| Frequency bands | GSM850/EGSM900/DCS1800/PCS1900 |
| GPS | GPS/GLONASS/Beidou |
| Dimensions | 30.0 × 25.0 x 3.0mm |
| Weight | 7g |
| Operating temperature | -35°C~+75°C |
| Limited temperature range | -40°C~+85°C |
| Storage temperature | -40°C~+85°C |
| Performance | |
| Operating voltage | 3.4V~4.2V<br>Typical=: 3.8V |
| Standard power consumption | Standby current: 24mA@-75dBm |
| | Sleep current：1mA |
| | Talk Current:: 128mA@-75dBm |
| | Max. Current: 300mA@-104dBm |
| Max. TX power | GSM850/EGSM900: Class 4 (2W) |
| | DCS1800/PCS1900: Class 1 (1W) |
| Rx. signal sensitivity | <-106dBm |
| Interfaces | |

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| Parameters | MG2639_V3 |
|---|---|
| Connector | 60pin Stamp-hole interface |
| Antenna | SMT 50Ω antenna connector |
| Integrated Full Duplex UART | AT commands/Data transmission |
| SIM card socket level | 1.8V/3.0V |
| Data service | |
| GPRS | Class 10 |
| Mobile Station | Class B |
| Max Downlink | 85.6kbps |
| Max Uplink | 42.8kbps |
| Protocol | Internal TCP/IP & UDP protocol stack |
| | Embedded FTP |
| SMS | |
| | Support TEXT/PDU Mode |
| | Point-to-point MO/MT |
| | SMS Cell Broadcast |
| Voice call | |
| | Audio encoder HR/FR/EFR/AMR// |
| | Echo Cancellation/Volume Control/DTMF |
| AT Command Set | |
| | GSM 07.05/GSM 07.07/ZTE Proprietary AT Commands |

## 1.2 Module's application block diagram

See the application block diagram of MG2639_V3 in the following figure:

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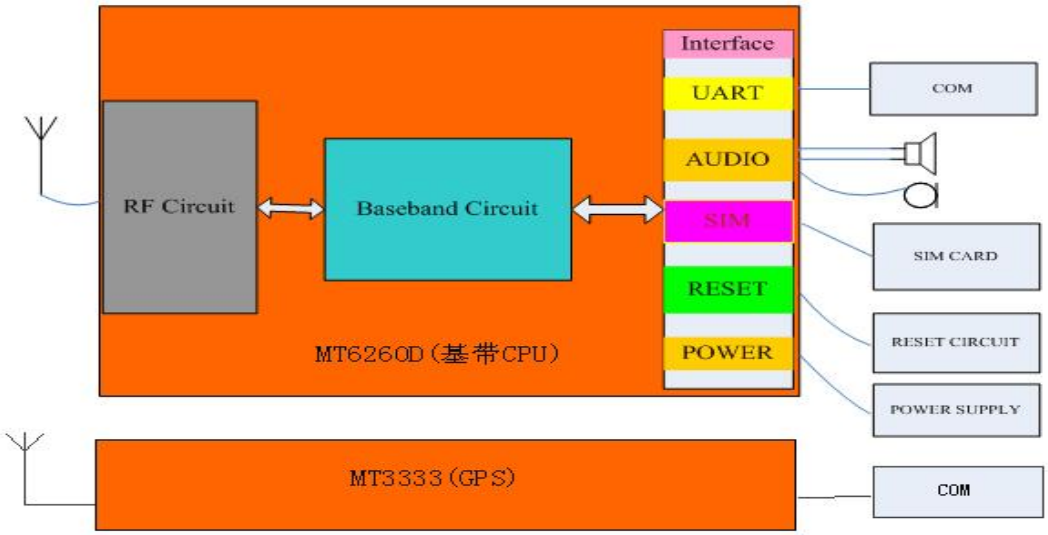
Figure 1-1 Module's application block diagram




## 1.3 Abbreviations

| | | |
|---|---|---|
| **A** | | |
| **ADC** | Analog-Digital Converter | |
| **AFC** | Automatic Frequency Control | |
| **AGC** | Automatic Gain Control | |
| **ARFCN** | Absolute Radio Frequency Channel Number | |
| **ARP** | Antenna Reference Point | |
| **ASIC** | Application Specific Integrated Circuit | |
| **B** | | |
| **BER** | Bit Error Rate | |
| **BTS** | Base Transceiver Station | |
| **C** | | |
| **CDMA** | Code Division Multiple Access | |
| **CDG** | CDMA Development Group | |
| **CS** | Coding Scheme | |
| **CSD** | Circuit Switched Data | |
| **CPU** | Central Processing Unit | |
| **D** | | |
| **DAI** | Digital Audio interface | |
| **DAC** | Digital-to-Analog Converter | |
| **DCE** | Data Communication Equipment | |
| **DSP** | Digital Signal Processor | |
| **DTE** | Data Terminal Equipment | |
| **DTMF** | Dual Tone Multi-Frequency | |
| **DTR** | Data Terminal Ready | |
| **E** | | |
| **EDGE** | Enhanced Data Rate for GSM Evolution | |
| **EFR** | Enhanced Full Rate | |
| **EGSM** | Enhanced GSM | |

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| | | |
|---|---|---|
| **EMC** | Electromagnetic Compatibility | |
| **EMI** | Electro Magnetic Interference | |
| **ESD** | Electronic Static Discharge | |
| **ETS** | European Telecommunication Standard | |
| **F** | | |
| **FDMA** | Frequency Division Multiple Access | |
| **FR** | Full Rate | |
| **G** | | |
| **GPRS** | General Packet Radio Service | |
| **GSM** | Global Standard for Mobile Communications | |
| **GPS** | Global Positioning System | |
| **H** | | |
| **HR** | Half Rate | |
| **I** | | |
| **IC** | Integrated Circuit | |
| **IMEI** | International Mobile Equipment Identity | |
| **ISO** | International Standards Organization | |
| **ITU** | International Telecommunications Union | |
| **L** | | |
| **LCD** | Liquid Crystal Display | |
| **LED** | Light Emitting Diode | |
| **M** | | |
| **MCU** | Machine Control Unit | |
| **MMI** | Man Machine Interface | |
| **MS** | Mobile Station | |
| **MTBF** | Mean Time Before Failure | |
| **P** | | |
| **PCB** | Printed Circuit Board | |
| **PCL** | Power Control Level | |
| **PCS** | Personal Communication System | |
| **PDU** | Protocol Data Unit | |
| **PLL** | Phase Locked Loop | |
| **PPP** | Point-to-point protocol | |
| **R** | | |
| **RAM** | Random Access Memory | |
| **RF** | Radio Frequency | |
| **ROM** | Read-only Memory | |
| **RMS** | Root Mean Square | |
| **RTC** | Real Time Clock | |
| **S** | | |
| **SIM** | Subscriber Identification Module | |
| **SMS** | Short Message Service | |
| **SMT** | Surface Mount Technology | |
| **SRAM** | Static Random Access Memory | |
| **T** | | |
| **TA** | Terminal adapter | |
| **TDMA** | Time Division Multiple Access | |
| **TE** | Terminal Equipment also referred it as DTE | |
| **U** | | |
| **UART** | Universal asynchronous receiver-transmitter | |

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| | | |
|---|---|---|
| **UIM** | User Identifier Management | |
| **USB** | Universal Serial Bus | |
| **USIM** | Universal Subscriber Identity Module | |
| **V** | | |
| **VSWR** | Voltage Standing Wave Ratio | |
| **Z** | | |
| **ZTE** | ZTE Corporation | |

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# 2 Descriptions of module's external interfaces

MG2639_V3 module connects externally through a 60PIN stamp-hole interface.

## 2.1 Definitions of module's interfaces

See the definitions of MG2639_V3 module's 60PIN stamp-hole interface in the following table:

Table 2-1 60pin stamp-hole definitions

| PIN No. | PIN Name | Functions | Default signal direction, whether or not used for GPIO（X） | Descriptions | Remarks |
|---|---|---|---|---|---|
| 1 | GND | Ground | | Ground | |
| 2 | RF_ANT | RF | I/O | RF antenna plug | |
| 3 | GND | Ground | | Ground | |
| 4 | RING | UART1 | Output, GPIO9 | Ringer signal indication | The voltage varies upon an incoming call or receipt of text message. 2.8V IO |
| 5 | GND | Ground | | Ground | |
| 6 | VBAT | Power | Input | Work voltage | 3.4~4.2V |
| 7 | RSSI_LED | LED | Output, GPIO58 | Network signal indication | --Need add dynatron to drive. The LED is ON at high level.<br>-Power on state: the LED is off;<br>- Network searching state: the LED blinks at 3Hz<br>- Idle state: the LED blinks at 1Hz<br>-Traffic state (call, data): the LED blinks at 5Hz |
| 8 | URTS1 | UART1 | Output, GPIO47 | Ready to send | 2.8V IO |
| 9 | UCTS1 | UART1 | Input, GPIO48 | Clear to send | 2.8V IO |
| 10 | DCD1 | UART1 | Output, GPIO15 | Carrier detection | 2.8V IO |
| 11 | SIM_RST | SIM card | Output | SIM card reset | |
| 12 | SIM_CLK | SIM card | Output | SIM card clock | |
| 13 | SIM_DATA | SIM card | I/O | SIM card data | |
| 14 | VSIM | SIM card | Output | SIM card voltage | |
| 15 | GND | Ground | | Ground | |

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| | | | | | |
|---|---|---|---|---|---|
| 16 | GPS_ANT | GPS | Input | GPS antenna | |
| 17 | GND | Ground | | Ground | |
| 18 | V_GPS | GPS | Input | GPS power input | 3.4V~4.2V |
| 19 | GPS_URXD | GPS | Input | GPS port | 2.8V IO |
| 20 | GPS_UTXD | GPS | Output | GPS port | 2.8V IO |
| 21 | VRTC | GPS RTC Power | Input | Connect button battery | 2.0V~3.3V |
| 22 | GPS_FIXED_LED | GPS | Output | GPS status indicator | 2.8V IO，externally connect dynatron to drive the LED |
| 23 | BATSNS | Charging control | Input | Battery voltage detection | Need externally connect charging circuit |
| 24 | ISENSE | Charging control | Input | Charging current detection | Need externally connect charging circuit |
| 25 | VCHG | Power | Input | Charging power | 4.3V~5V |
| 26 | CHR_LDO | Charging control | Output | Charging ON/OFF | 2.8V |
| 27 | GATDRV | Charging control | Output | Charging dynatron control | Need externally connect charging circuit |
| 28 | ADCIN | Analogue signal input | Input | ADC voltage detection | 0~2.8V |
| 29 | URXD1/SPIMOSI | UART1/SPI | Input, GPIO20 | Receiving data for serial port, UART1 can be used as SPI interface when not used | 2.8V IO |
| 30 | UTXD1/SPIMISO | UART1/SPI | Output，GPIO21 | Port sending, UART1 can be used as SPI interface when not used | 2.8V IO |
| 31 | SYSRST_N | Reset | Input | Reset signal | Valid at low level |
| 32 | EAR_L | Analogue audio | Output | Earpiece speaker anode | |
| 33 | RECP | Analogue audio | Output | Receiver speaker anode | |
| 34 | RECN | Analogue audio | Output | Receiver speaker cathode | |
| 35 | MIC_P1 | Analogue audio | Input | Earpiece MIC anode | |
| 36 | MIC_P0 | Analogue audio | Input | Receiver MIC anode | |
| 37 | MIC_N0 | Analogue audio | Input | Receiver MIC cathode | |
| 38 | PWRKEY_N | Power key | Input | Power on/off | Valid at low level; need external connect a open-collector or open-drain switch. |
| 39 | DTR1 | UART1 | Input, GPIO5 | Data terminal ready _WAKEUP | 2.8V IO |
| 40 | DSR1 | UART1 | Output, | Data set ready | 2.8V IO |

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| | | | | | |
|---|---|---|---|---|---|
| | | | GPIO19 | | |
| 41 | VDDIO | LDO output | Output | 2.8V | |
| 42 | GND | Ground | | Ground | |
| 43 | URXD2 | UART2 | Input, GPIO22 | Receiving data from serial port | 2.8V IO |
| 44 | UTXD2 | UART2 | Output, GPIO23 | Transmitting data from serial port | 2.8V IO |
| 45 | USB_DM | USB | I/O | USB data - | |
| 46 | USB_DP | USB | I/O | USB data + | |
| 47 | LSDA0 | Serial LCD | Output，GPIO38 | Serial LCD data cable data0 | 1.8V IO |
| 48 | LSCE0B0 | Serial LCD | Output，GPIO40 | Serial LCD enabled | 1.8V IO |
| 49 | LSRSTB | Serial LCD | Output，GPIO46 | Serial LCD reset | 1.8V IO |
| 50 | LSCK0 | Serial LCD | Output，GPIO37 | Serial LCD clock cable | 1.8V IO |
| 51 | LSDI0 | Serial LCD | Input，GPIO39 | Serial LCD data cable input | 1.8V IO |
| 52 | LSA0DA0 | Serial LCD | Output，GPIO36 | Serial LCD data cable1 | 1.8V IO |
| 53 | SDA28/SPICS | I2C/SPI | I/O，GPIO2 | I2C data cable, also used for SPI chip select | 2.8V IO |
| 54 | SCL28/SPISCK | I2C/SPI | Output，GPIO1 | I2C clock cable, also used for SPI clock; | 2.8V IO |
| 55 | PWM/EARDET | PWM output | Output，GPIO0 | PWM output, PWM can be used as earpiece insert detection when not used | 2.8V IO |
| 56 | PCMRST | PCM reset | Output，GPIO56 | Reset external PCM settings | 2.8V IO |
| 57 | PCMOUT | PCM | Output，GPIO54 | PCM data output | 2.8V IO |
| 58 | PCMCLK | PCM | Output，GPIO50 | PCM clock | 2.8V IO |
| 59 | PCMSYNC | PCM | Output，GPIO55 | PCM bytes SYNC | 2.8V IO |
| 60 | PCMIN | PCM | Input，GPIO53 | PCM data input | 2.8V IO |

## 2.2 Antenna Interface

Regarding the antenna of MG2639_V3 module, proper measures should be taken to reduce the access loss of effective bands, and good shielding should be established between external antenna

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and RF connector. Besides, external RF cables should be kept far away from all interference sources such as high-speed digital signal or switch power supply.

According to the standard for mobile devices, the stationary wave ratio of MG2639_V3 module's antenna should be between 1.1 and 1.5, and input impedance is 50 ohm. Different environments may have different requirements on the antenna's gain. Generally, the larger gain in the band and smaller outside the band, the better performance the antenna has.

Isolation degree among ports must more than 30dB when multi-ports antenna is used. For example, between two different polarized ports on dual-polarized antenna, two different frequency ports on dual-frequency antenna, or among four ports on dual-polarized dual-frequency antenna, isolation degree should be more than 30dB.

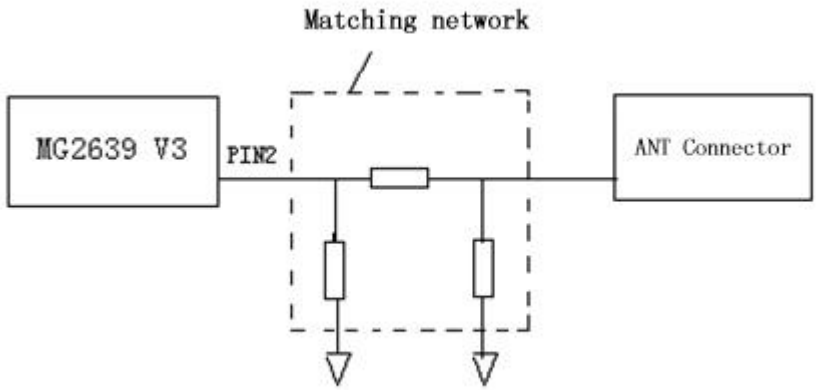
MG2639_V3 module provides both GSM and GPS antenna interface, and either interface provides both RF socket and stamp-hole connection method; therefore users can select reasonably according to the product form to optimize the cost of BOM.

Scenario 1：

PIN2 and PIN16 are respectively used as the input pin for GSM and GPS antenna. Pay attention to the following when using it as the antenna's feed PIN:

（1） The feed connected to PIN2 or PIN 16 is 50ohm micro-strip or strip line. To approach the module, put π shape matching network for later tuning. See π shape matching network in the diagram below:

Figure 2-1 π shape matching network diagram




（2）The RF wires must be kept away from the GND, and generally the distance should be 3 times of the width of RF wires.

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（3）It’s forbidden to put some interference sources such as DC to DC, WIFI module around RF wires or RF port.

Scenario 2:

When using GSM/GPS RF socket as the antenna feed, disconnect PIN2/PIN16 from the main board and make sure there are some empty areas below or around PIN2/PIN16. Keep 2mm distance between the surface of PIN2/PIN16 and GND, and drill holes below PIN2/PIN16. It’s not suggested to use the compatible design of PIN2/PIN16 at the same time when using the RF connector.

Figure 2-2 Antenna interface diagram

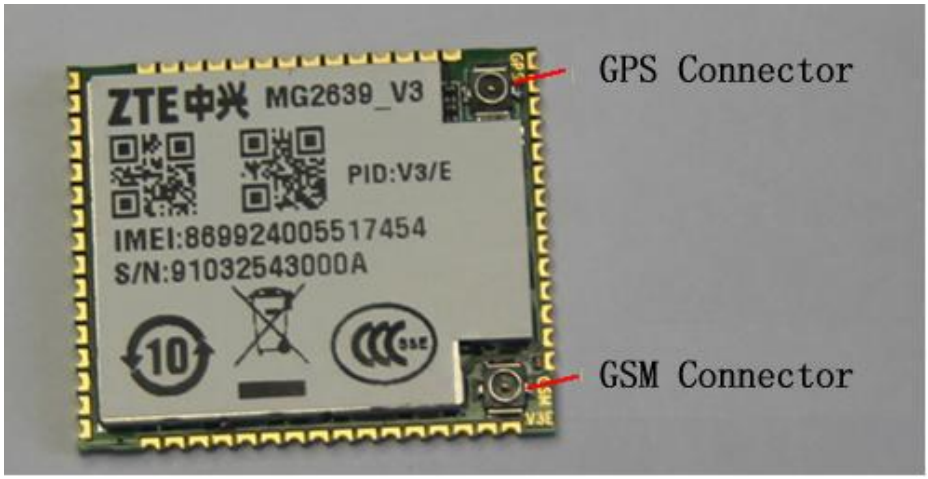


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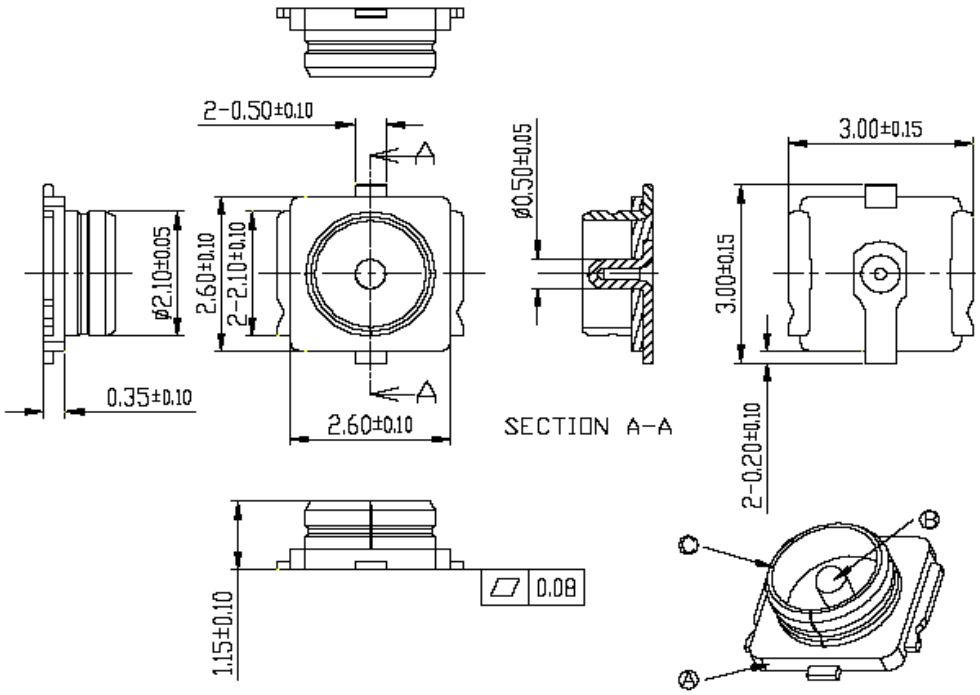
Figure 2-3 RF test socket dimensions




## 2.3 Antenna interface's RF performance

See the antenna interface's RF performance in table 2-2:

Table 2-2 Antenna interface's RF performance

| Antenna interface's RF performance | Module's uplink （MS->BTS） | Module's downlink （BTS->MS） | Max. Tx. Power （dBm） | Antenna interface's Rx. sensitivity |
|---|---|---|---|---|
| GSM850 | 824MHz-849MHz | 869MHz-894MHz | 33±2 | < -107dBm |
| EGSM900 | 880MHz-915MHz | 925MHz-960MHz | 33±2 | < -107dBm |
| DCS1800 | 1710MHz-1785MHz | 1805MHz-1880MHz | 30±2 | < -106dBm |
| PCS1900 | 1850MHz-1910MHz | 1930MHz-1990MHz | 30±2 | < -106dBm |

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# 3 Module's electrical characteristics

The chapter mainly describes the module's electrical characteristics, including the level, power consumption, reliability of module's interfaces.

## 3.1 Descriptions of levels of interface signals

It describes the MAX, MIN and typical value of the level of module's external interfaces.

### 3.1.1 Reset

The reset PIN is pulled up to 2.8V（Vmax=2.9V，Vmin=2.7V，Typical=2.8V）through the resistance inside the module.

The SYSRST_N PIN is used to reset the module's main chipset. Pull down the SYSRST_N signal 500ms to reset the module.

### 3.1.2 UART

MG2639_V3 module provides three serial interfaces. The UART1 supports 8-wire serial BUS interface (see signal definitions in table 4-3); while UART2 supports 2-wire serial interface only. The module can communicate externally and input the AT commands through the UART interface. The GPS UART is used for GPS information output.

Table 3-1 UART interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| UART1 | 29 | URXD1 | Output | Receiving data from serial port | 2.8V IO |
| | 30 | UTXD1 | Input | Transmitting data from serial port | 2.8V IO |
| UART2 | 43 | URXD2 | Output | Receiving data from serial port | 2.8V IO |
| | 44 | UTXD2 | Input | Transmitting data from serial port | 2.8V IO |
| GPS UART | 19 | GPS_URXD | Output | Receiving data from serial port | 2.8V IO |
| | 20 | GPS_UTXD | Input | Transmitting data from serial port | 2.8V IO |

### 3.1.3 I2C

MG2639_V3 module provides one I2C BUS interface. SCL and SDA have been pulled up to 2.8V through 2.2K resistance inside the module, and it supports 7BIT/10BIT seeking and high-speed transmission mode.

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Table 3-2 I2C interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| I2C | 53 | SDA | I/O | I2C data cable | 2.8V IO |
| | 54 | SCL | Output | I2C clock cable | 2.8V IO |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.4 SPI

MG2639_V3 module provides one SPI BUS interface, SPICS & SPISCK signal multiplex with the I2C interface, while SPIMOSI & SPIMISO signals multiplex with the UART interface. When UART2 and I2C function are not used, it can be configured as the SPI interface.

Table 3-3 SPI Interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| SPI | 53 | SPICS | Output | SPI chip select | 2.8V IO |
| | 54 | SPISCK | Output | SPI clock | 2.8V IO |
| | 29 | SPIMOSI | Input | SPI data input | 2.8V IO |
| | 30 | SPIMISO | Output | SPI data output | 2.8V IO |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.5 PCM

MG2639_V3 module adopts its 56-60 PINs as the PCM interface, through which users can expand the audio DAC.

Table 3-4 PCM interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| PCM | 56 | PCMRST | Output | Reset external PCM settings | 2.8V IO |
| | 57 | PCMOUT | Output | PCM data output | 2.8V IO |
| | 58 | PCMCLK | Output | PCM clock | 2.8V IO |
| | 59 | PCMSYNC | Output | PCM bytes SYNC | 2.8V IO |
| | 60 | PCMIN | Input | PCM data input | 2.8V IO |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

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### 3.1.6 USB

MG2639_V3 module integrates the USB interface and conforms to USB1.1 interface specifications. The module can connect the host through the interface and provide up to 12Mbps data rate. Users can upgrade the software via the interface.

Table 3-5 USB interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| USB | 45 | USB_DM | I/O | USB data - | |
| | 46 | USB_DP | I/O | USB data + | |

### 3.1.7 ADC

MG2639 module's 28th pin can provide up to 98.1 KSPS sampling rate and 10BIT A/D conversion function.

Table 3-6 ADC interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| ADC | 28 | ADCIN | Input | Analogue signal input | 0-2.8V |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.8 PWM

Table 3-7 PWM interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| PWM | 55 | PWM | output | Pulse width modulation output | 2.8V IO |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.9 LCD

MG2639 V3 module provides a serial LCD interface and supports the LCD device with serial communication. It supports up to 480*320 resolutions.

Table 3-8 LCD interface signal definitions

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| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| LCD | 47 | LSDA0 | Output | Serial LCD data cable data0 | |
| | 48 | LSCE0B0 | Output | Serial LCD enabled | |
| | 49 | LSRSTB | Output | Serial LCD reset | |
| | 50 | LSCK0 | Output | Serial LCD clock cable | |
| | 51 | LSDI0 | Output | Serial LCD data cable input | |
| | 52 | LSA0DA0 | Output | Serial LCD data cable data1 | |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.10 GPS/GLONASS/Beidou

MG2639_V3 module's GPS function is completely independent from its wireless data communication. The GPS cell provides independent power input and PIN to output the GPS information through the serial port.

Table 3-9 GPS/GLONASS/Beidou interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| GPS | 16 | GPS_ANT | Input | GPS antenna | |
| | 18 | V_GPS | Input | GPS power input | 3.4-4.3V |
| | 19 | GPS_URXD | Input | GPS port | NMEA data syntax |
| | 20 | GPS_UTXD | Output | GPS port | NMEA data syntax |
| | 21 | VRTC | Input | RTC power | Can connect to the button battery |
| | 22 | GPS_FIXED_LED | Output | GPS status indicator | Valid at high level |

Table 3-10 GPS basic parameters

| Frequency | C/N0 (-130dB) | Searching satellites current | STANDBY mode Current (3.8V) | SLEEP mode Current (3.8V) | BACKUPmode current (3.8V) |
|---|---|---|---|---|---|
| 1575.42MHz | 40 | 28mA | 400uA | 6mA | 50uA |

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### 3.1.11 Charging

MG2639 V3 module provides the charging of Li battery through the design of external circuits.

See section 4.5 for external reference design.

Table 3-11 Charging interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| Charging | 23 | BATSNS | Input | Charging control | Battery voltage detection |
| | 24 | ISENSE | Input | Charging control | Battery current detection |
| | 25 | VCHG | Input | Power | Charging power supply |
| | 26 | CHR_LDO | Output | Charging control | Charging on/off |
| | 27 | GATDRV | Output | Charging control | Charging dynatron control |

***Note: the software doesn't support this interface by default, therefore it requires customization.***

### 3.1.12 SIM card interface

MG2639_V3 module supports the SIM card interface conforming to ISO 7816-3 standard, and it supports SIM cards with two different standards: 1.8V and 3.0V.

Users should note that the SIM card's electrical interface should be defined exactly the same as the SIM card socket.

Table 3-12 SIM card interface signal definitions

| Classification | No. | Definitions | I/O | Description | Remarks |
|---|---|---|---|---|---|
| SIM | 14 | VSIM | Output | SIM card voltage | 1.8V/3V, Max. output current 30 mA |
| | 11 | SIM_RST | Output | SIM card reset | |
| | 12 | SIM_CLK | Output | SIM card clock | |
| | 13 | SIM_DATA | I/O | SIM card data | |

### 3.1.13 Audio interface

MG2639_V3 module supports 2CH audio signal inputs/outputs. The two MIC inputs are internally capacitive coupled with the offset voltage, and directly connected to the receiver. See the audio interface signals in the table 3-2:

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Table 3-13 Audio interface signal definitions

| Classification | No. | Definition | I/O | Description | Remarks |
|---|---|---|---|---|---|
| AUDIO | 37 | MIC_N0 | Input | Receiver on the host | Differential input |
| | 36 | MIC_P0 | Input | Receiver on the host | |
| | 35 | MIC_P1 | Input | Receiver on the earpiece | Differential input |
| | 34 | RECN | Output | Speaker on the host | Differential output |
| | 33 | RECP | Output | Speaker on the host | |
| | 32 | EAR_L | Output | Speaker on the earpiece | Single-ended output |

### 3.1.14 Network signal indication

The RSSI_LED is driven at high level.
---Power-on status: the LED turns off;
---Network searching status: the LED blinks at 3Hz;
---Idle status: the LED blinks at 1Hz;
---Traffic status (call, data): the LED blinks at 5Hz.

The output status of RSSI_LED PIN is defined according to the software protocol. The RSSI_LED PIN is a general I/O port with the output driving capability 4mA.

## 3.2 Module's power consumption

It describes the module's power consumption under each status:

Table 3-14 MG2639_V3 (GPRS) power consumption

| Status | Frequency | Rx. power | Min. | Average | Max. | Remarks |
|---|---|---|---|---|---|---|
| Power-off | | | | 15uA | | VBAT=4.0V |
| Sleep | | | | 2mA | | |
| Standby | | | | 24 mA | | |
| Call | GSM850 | | | 240mA | | |
| | EGSM900 | | | 240mA | | |
| | GSM1800 | | | 180 mA | | |
| | GSM1900 | | | 175 mA | | |
| Network searching | | | | 78mA | | |

## 3.3 Reliability characteristics

The module's reliability testing items include: High/low temperature operation, high/low temperature storage, thermal shock, alternating temperature humidity, etc. The test results must conform to the industrial requirements. See the module's working temperature in the table below:

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Table 3-15 MG2639_V3 module's temperature characteristics

| Parameters | Descriptions | Min. | Max. | Remarks |
|---|---|---|---|---|
| To | Operation temperature | -35℃ | 75℃ | |
| Ta | Limited temperature | -40℃ | +85℃ | Make sure not to compromise the RF performance apparently |
| Ts | Storage temperature | -40℃ | +85℃ | |

## 3.4 ESD characteristics

See the ESD characteristics at room temperature.

Table 3-16 ESD characteristics

| Interface | Testing items | Testing requirements | Performance |
|---|---|---|---|
| Antenna interface | Air discharge | ±8 kV | Nothing unusual |
| | Contact discharge | ±6 kV | Nothing unusual |
| SIM card interface | Air discharge | ±8 kV | Nothing unusual |
| | Contact discharge | ±6 kV | Nothing unusual |

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# 4 Interface circuit design

The chapter provides the reference design on the interface circuit according to the module's functions and describes the precautions.

## 4.1 Reset and power design

See the reference design principle of power and reset circuit in figure 4-1. Select appropriate parameters according to the actual selected power supply since VD1 is TVS tube, and select CJ2305 from Changjiang Electronics or DMP2305U-7 from DIODES since VT1 is MOS tube. Refer to figure 4-2 for the design of power circuit. Select MIC29302 and adjust the output voltage through the adjustment of R5 and R6. Please refer to MIC29302's specification for detailed parameters design. Please note that the components in the figure are just for your reference. For details, please adjust according to the actual circuit.

Figure 4-1 Power & reset circuit reference design principle diagram

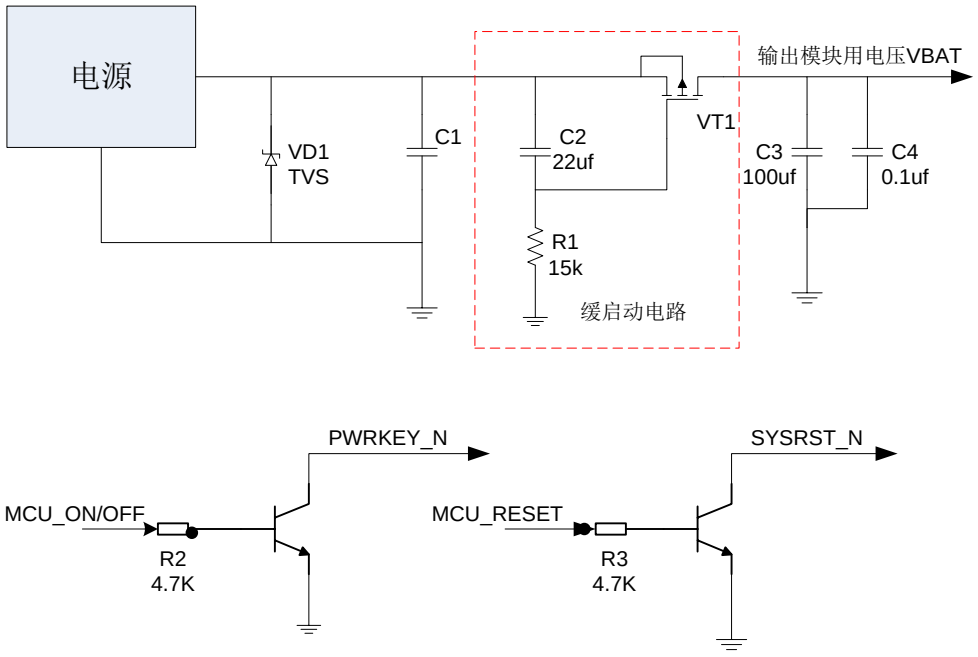


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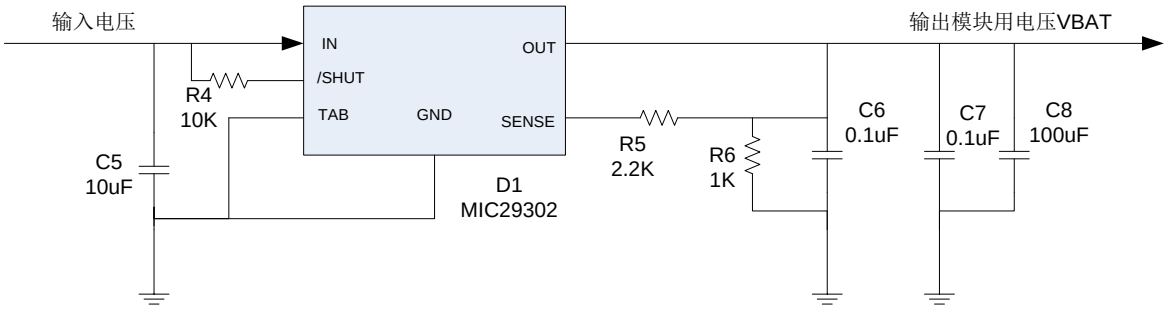
Figure 4-2 Power reference circuit




- Power design

MG2639_V3 module is powered by VBAT. If the external power cannot be stably started, it's recommended to add buffer circuit in the circuit. See the module's required voltage characteristics in table 4-1.

Table 4-1 Voltage characteristics

| Classification | Vmin | Typical | Vmax |
|---|---|---|---|
| Input voltage | 3.4V | 3.8V | 4.2V |
| Input current | 1mA | -- | 300mA（Depends on the network signal） |

The module is very strict with the requirements on the power supply and grounding:
(1). The filtering must be performed on the power and grounding, and the power ripple must be controlled under 50Mv. Do not power any other part in the system because it might affect the RF performance.
(2). Select the power cables with at least 80mil traces during the layout and keep the integrality of ground line.
(3). Make sure the Max. instantaneous output current is larger than 2A if the Max. input current is very high.

- Power on

The module is under power-off status after it's normally powered on. To turn on the module, provide a 2s-5s low level pulse to the PWRKEY_N PIN. If one 1K resistance is connected with the PWRKEY_N PIN, the module can be automatically powered on after connected to the power supply.

- Power off

To turn off the module, use AT command "AT+ZPWROFF" or provide a 2s~5s low level pulse to the PWRKEY_N PIN.

- Reset

Use the above method to firstly "power-off" and then "power-on" to hard reset the module.
If the external reset function has to be used, provide a low level pulse lasting at least 500ms to the SYSRST_N PIN within 2 seconds after the module is turned on. Before that, the external MCU_RESET signal must be kept at low level. See the reset circuit design in figure 4-1.

Suspend the SYSRST_N PIN if not used.

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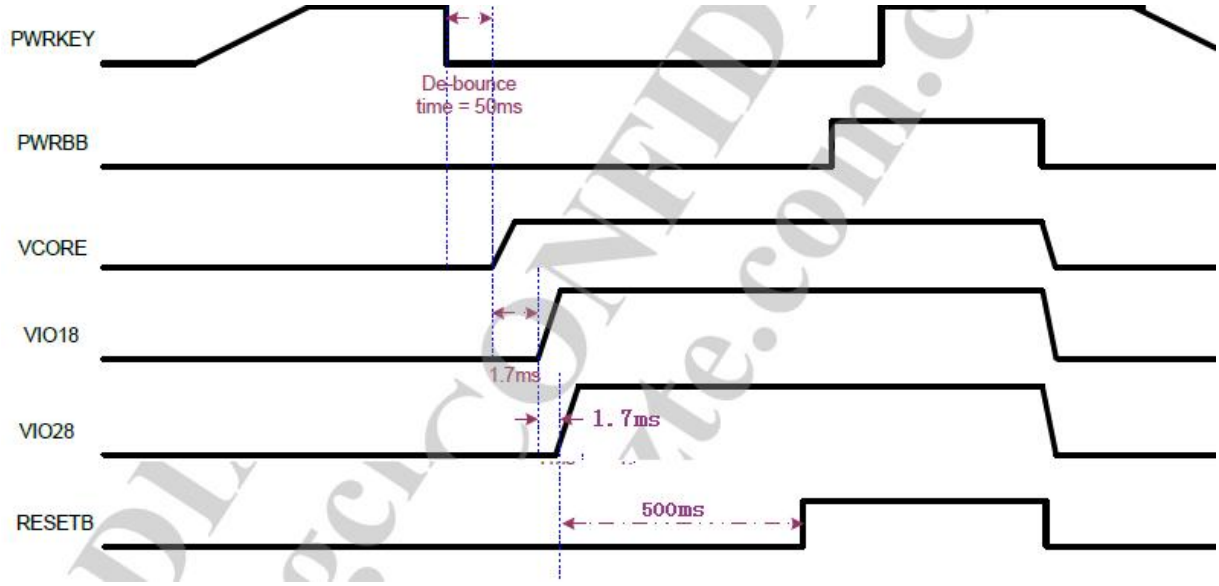
See the module's power-on/off time sequence in figure 4-3 below:

Figure 4-3 Power-on/off time sequence




- VDDIO

The module has one LDO voltage output pin, which can be used to supply external power to the main board. The voltage output is available only when the module is on. The normal output voltage is 2.8V, and users should absorb the current from this pin as little as possible (less than 10mA). Generally, it is recommended to use this pin to pull up the chipset PIN as per the requirements of level matching. Therefore, it's not recommended to use this pin for other purposes.

- Other advice

In order to make sure the data is saved safely and guarantee the safety of module's data, please don't cut off the power when the module is on.

## 4.2 UART interface

MG2639_V3 module provides an integrated full duplex UART1 interface (shortly referred to as UART interface) and an accessorial UART2 interface. The default baud rate is 115200bps and the external interface adopts 2.8V CMOS level signal, which conforms to RS-232 interface protocol. The UART1 interface could be used as serial interface for AT commands, data service. The UART2 interface can be used to debug the applications.

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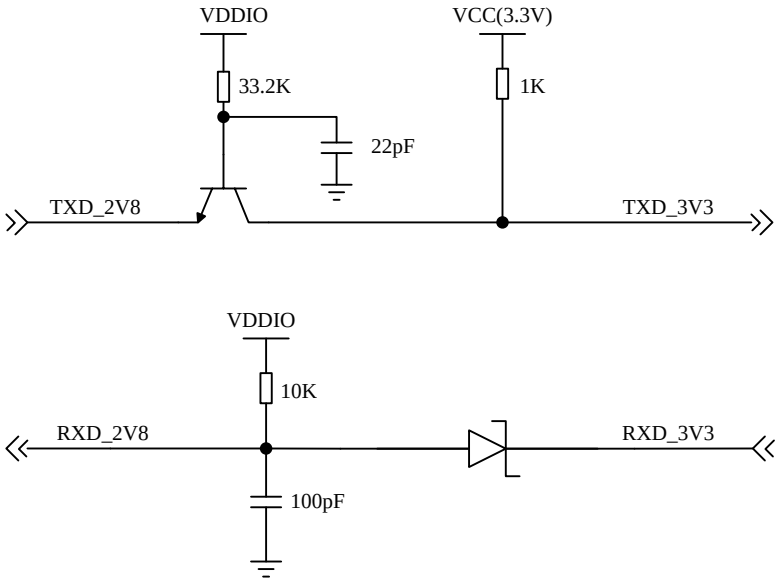
MG2639_V3 module's output I/O level is 2.8V, therefore it needs level conversion when connecting with standard 3.3V or 5V logic circuit（such as MCU or RS232 drive chip MAX3238）. The most common method is to use a dynatron to realize the level conversion. Figure 4-3 shows the level conversion to 3.3V through the UART interface of MG2639_V3. The resistance and capacitance in figure 4-3 are just for reference, and they need to be recalculated during the design. The diode in Figure 4-4 is Schottky diode (forward voltage drop is 0.3V). If you select other diodes, please select one with lower forward voltage drop to make sure RXD_2V8 is below the threshold when inputting low level.

Figure 4-4 UART interface reference design diagram

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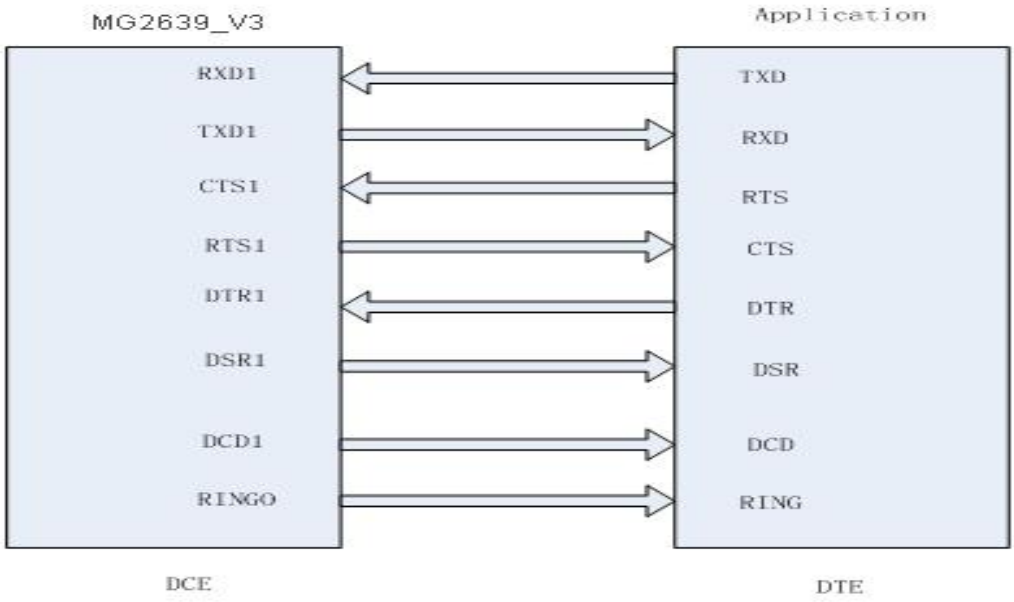
### 4.2.1 Descriptions of UART1 interface

Figure 4-5 UART1 DCE—DTE connection relationship diagram




See the definitions of UART1 interface in table 4-3.

Table 4-3 UART1 interface definitions

| Classification | No. | Definitions | I/O | Descriptions | Remarks |
|---|---|---|---|---|---|
| UART | 29 | RXD1 | Input | Receiving data | DTE transmits serial data |
| | 8 | RTS1 | Output | Ready to send | DTE informs DCE to send |
| | 30 | TXD1 | Output | Transmitting data | DTE receives serial data |
| | 39 | DTR1 | Input | Data terminal ready | DTE is ready |
| | 9 | CTS1 | Input | Clear to send | DCE has switched to Rx. mode |
| | 4 | RING | Output | Ringtone indication | Inform DTE upon a remote call |
| | 40 | DSR1 | Output | Data set ready | DCE is ready |
| | 10 | DCD1 | Output | Carrier detection | Data link connected |

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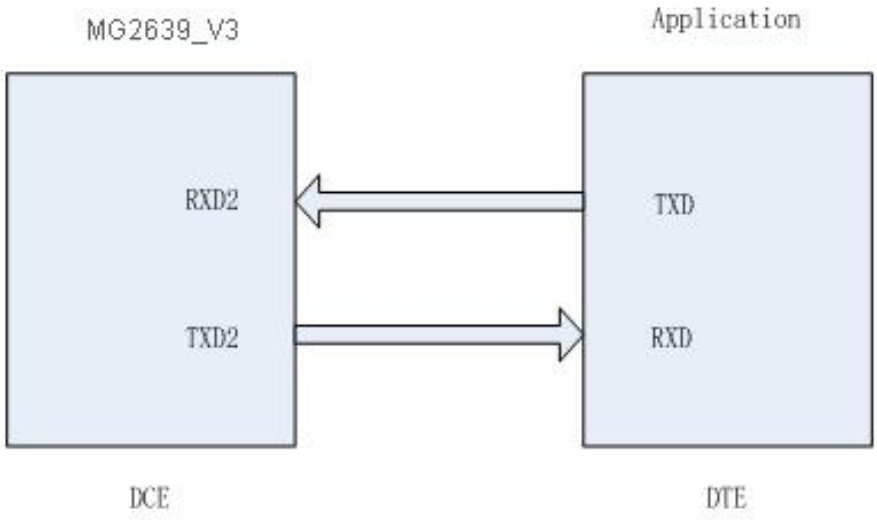
### 4.2.2 Descriptions of UART2 interface

Figure 4-6 UART2 DCE—DTE connection relationship diagram




See the definitions of UART2 interface in table 4-4.

Table 4-4 UART2 interface definitions

| Classification | No. | Definitions | I/O | Descriptions | Remarks |
|---|---|---|---|---|---|
| UART | 43 | RXD2 | Input | Receiving data | DTE transmits serial data |
| | 44 | TXD2 | Output | Transmitting data | DTE receives serial data |

## 4.3 SIM card interface

MG2639_V3 module supports 1.8V or 3.0V SIM card. Refer to figure 4-7 for design.

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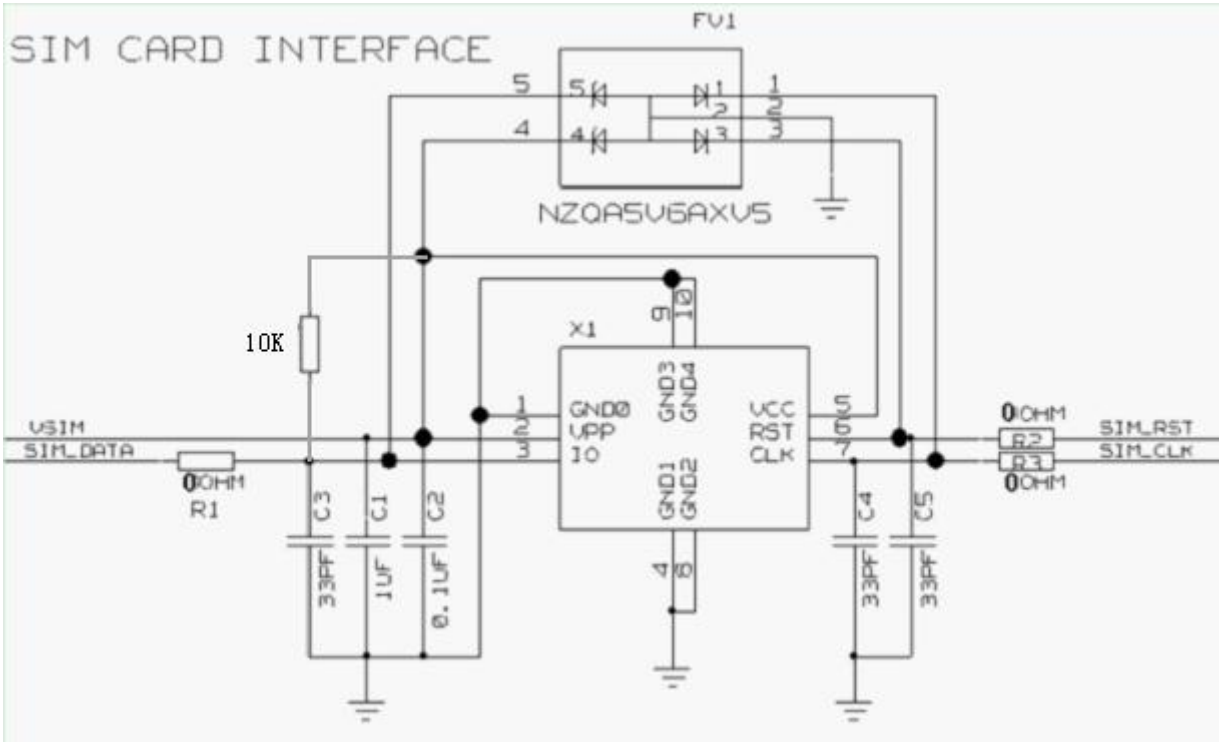
Figure 4-7 SIM card circuit reference design diagram




**NOTE**:

*(1) The SIM card PCB wiring should be laid closely around the module as much as possible.*

*(2) The VSIM, CLK, DATA and RST signals should be enveloped by the ground wires. The position of 33pF capacitance should be reserved on CLK, DATA and RST signals wiring and the position should be close to the SIM card socket to prevent the interference sources from affecting the SIM card's reading/writing.*

(3) *Since the ESD components are very close to the SIM card socket, it's recommended to add TVS components on 4-CH SIM card signals, meanwhile, the signal wires need go through TVS component before entering the module's baseband processor during the layout to avoid damaging the module.*

*(4) The width of VSIM power wiring should be above 6mil at least (recommended to use 8mil).*

*(5) The filter capacitance of VSIM power wiring adopts 1uf (the value can't be larger than 10uf or smaller than 1uf), and then 0.1uf capacitance is added.*

## 4.4 Audio interface

MG2639_V3 module provides audio input and output interfaces through its PINs. There are 2 Speaker interfaces and 2 Microphone interfaces. Only one pair I/O works at the same time. See the audio interface circuit in figure 4-8.

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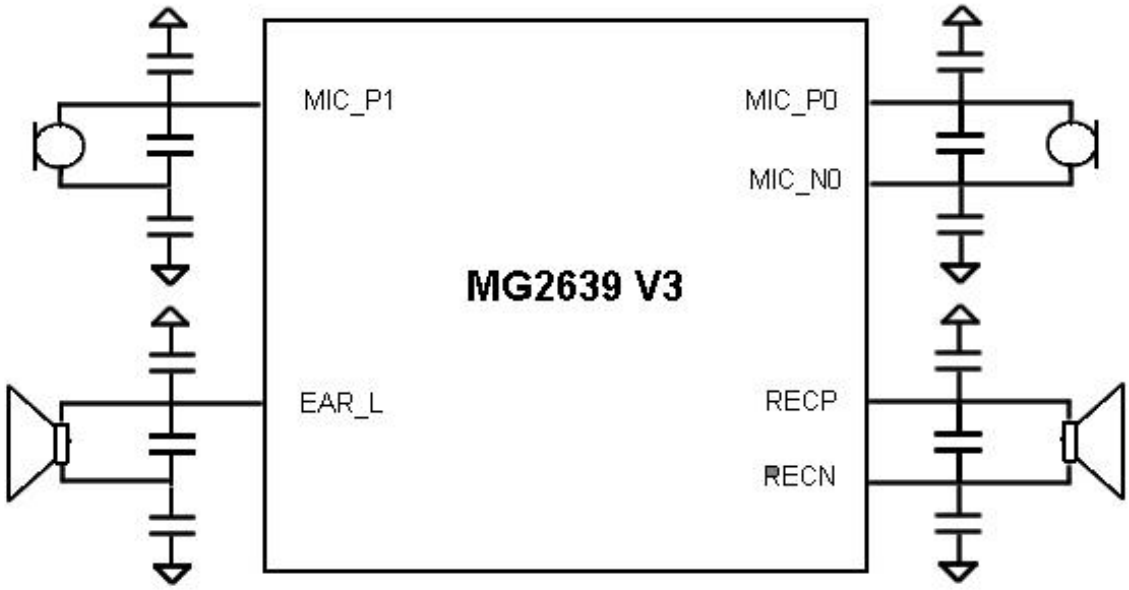
Figure 4-8 Audio interface circuit reference design principle diagram




- **Microphone**

The MIC_N0 & MIC_P0 are both differential interfaces, and they can also be used for single-ended input. It's recommended to use differential method to reduce the noises. The MIC2_P interface is used for single-ended input. Directly connect to the microphone since these two inputs are internally coupled and 1.9V offset voltage is generated.

- **Speaker**

The RECP & RECN are both differential interfaces with 32 ohm impedance, while the EAR_L is single-ended interface with 32 ohm impedance.

GSM/GPRS module audio interface is designed as below:

- Design of the audio interface on the receiver

Select the microphone with the sensitivity lower than -51.5dB since the max. gain inside MIC0 can reach 51.5dB. The level of MIC1_P0 is about 1.48V

**Note**: *if other kind of audio input method is adopted, the dynamic range of input signals should be within 0.5V. If the dynamic range is lower than 0.5V, then the pre-amplifier should be added. If the dynamic range is higher than 0.5V, then network attenuation should be added.*

- Design of the audio interface on the earpiece

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Select the microphone with the sensitivity lower than -51.5dB since the max. gain in MIC1 can reach 51.5dB. The level of MIC_P1 is about 1.73V.

Note: In order to get better audio effect for users, we present the following suggestions:

1）During the process of using MG2639_V3 module, it's advised to use 100pf & 33pf capacitance on its external audio path, and serially connect with the beads to improve the audio quality.

2）Connect TVS tube or pressure sensitive resistance on the audio path (approaching the module's interface) to prevent the ESD from damaging the module.

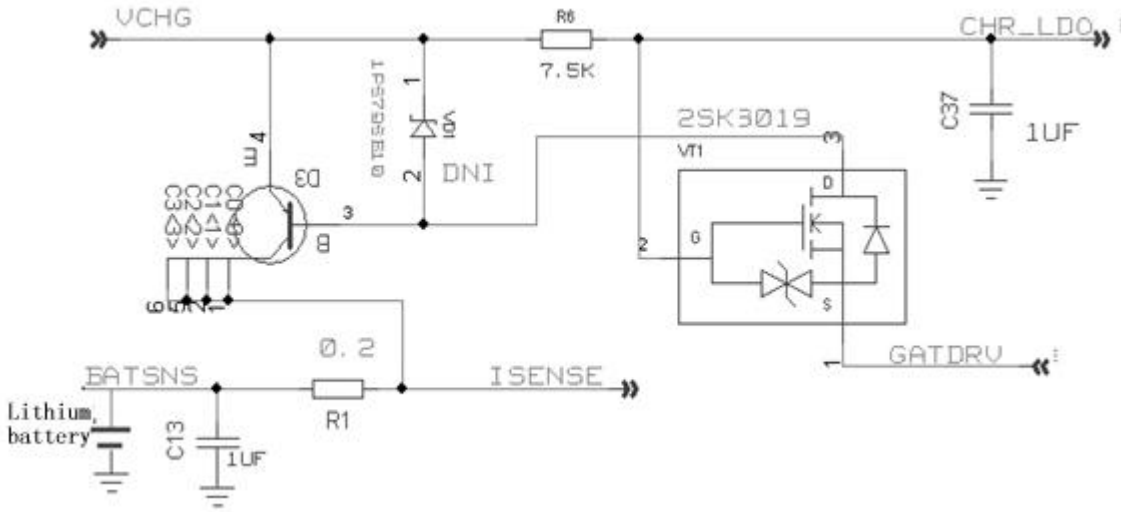
3）Make sure the use environment and module are well grounded and there is no mutual influence.

4）The power ripple supplied to the module is less than 50mV.

## 4.5 Charging interface

The PINs used for MG2639_V3 module's charging interface are 23-27 PINs. See the charging external connection in the figure below: D3 adopts CJ10P20DE6G or MBT35200MT1; VT1 adopts 2SK3019, NTA4001NT1 or SSM3K15FS; R1 is 0.2Ω current inspection resistance, which requires 1206 encapsulation.

Figure 4-9 Charging interface circuit reference design principle diagram

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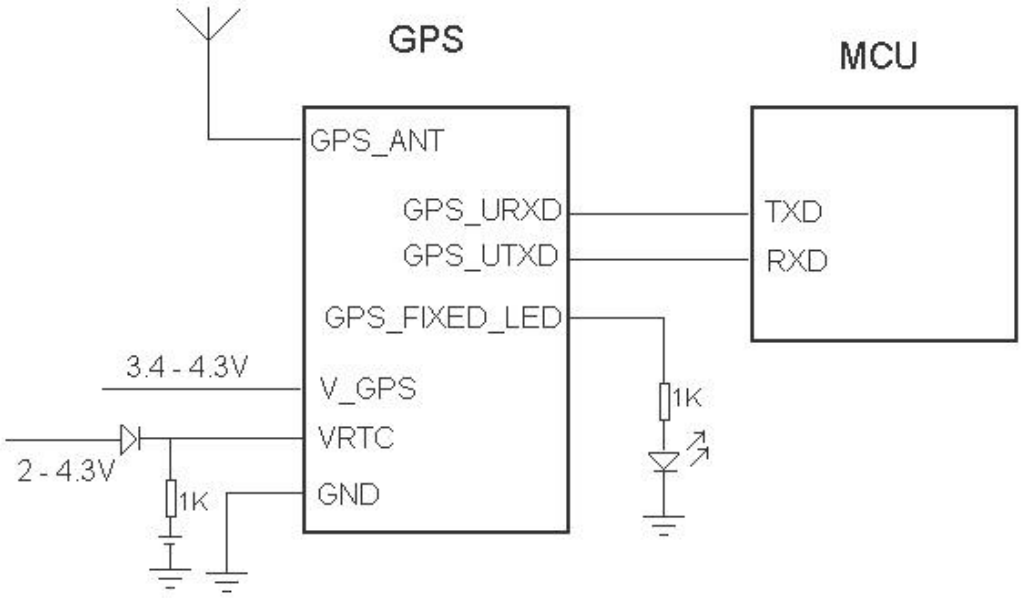
## 4.6 GPS Interface

Figure 4-10 GPS Interface Circuit Reference Principle Diagram

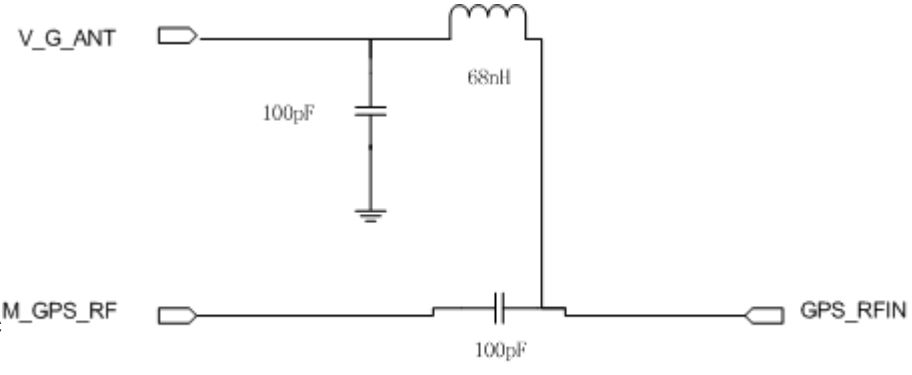



It's recommended to connect with GPS RF socket through a 50Ω RF cable. The good matching of antenna and module enables GPS to obtain better receiving sensitivity. V_GPS works as the PIN to supply 3.4-4.3V power to GPS; VRTC works as the PIN to supply 2-4.3V power to RTC; a button battery can also supply power to RTC. Keep power supplied by RTC can effectively shorten first positioning time as V_GPS powers up after power-down. If you don't ask too much of first positioning time as V_GPS powers up, you can directly connect VRTC to V_GPS power supply.

## 4.7 Connection Method of GPS Active Antenna

In the figure below, V_G_ANT works as the power supply of GPS antenna. Set V_G_ANT voltage according to the requirements of selected GPS active antenna, connect M_GPS_RF to GPS_ANT, and connect GPS_RFIN to GPS active antenna. The resistance of RF cable in the figure is 50Ω.

Figure 4-11 Active GPS antenna circuit reference design principle diagram

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# 5 PCB design

## 5.1 PCB design

1）Enough Pad area must be reserved for the module's grounding pin to guarantee adequate grounding and avoid interference on the sensitivity.

2）Copper-clad and wiring are forbidden in the nearby areas of the RF stamp-hole.

3）For the convenience of testing and maintenance, it is recommended to drill holes on the PCB to expose JTAG test points.

4）The wiring between the SIM card socket and MCU should be as short as possible to prevent signals from being affected by long wiring, which might result in the failure of SIM card recognition.

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# 6 Module Board's Mounting Process and Baking Guide

## 6.1 Module's mounting process

Now with the increasing number of module board products in our company, customers have encountered numerous welding problems of module boards during the process of using the products. Therefore, we specially formulate the guide to the module board's mounting process for customers in order to ensure the FTT of soldering at the client-end. The current standard of flatness in our company is 0.15mm (measurement method: put the module at the marble surface, use the feeler gauge to measure the clearance width at the maximum cocked position. Do not exert a force on the module during the measurement). If there is any question, please contact the relevant staff in our company. The module must be baked at 125℃ for 8 hours prior to second reflow.

### 6.1.1 Process Routing Selection

As our module boards are manufactured with the lead-free technology and meet the ROHS requirements, we recommend that the lead-free manufacturing process should be used upon the selection of process routing for module board and interface board.

### 6.1.2 Solder Paste Selection

The solder pastes with metal particle TYPE3 and TYPE4 can fulfill the welding requirements. It is accordingly recommended to use the no-clean solder paste. If the solder paste which needs cleaning is used, we cannot guarantee the components on the module board could withstand the washing of the cleaning solvents. This might cause the functional problems of such components and affect the appearance of the module. Make sure the thickness of solder paste at the module's PAD is between 0.18mm and 0.2mm during the printing.

### 6.1.3 Design of interface board's PAD & thicknesses of green oil and white oil at the module on the interface board

For the design of interface board's pad, please refer to the standard pad design recommended by ZTE Mobile Telecom Co., Ltd. It is recommended that the sum of the thickness of the green oil and white oil at the module on the interface board should be less than 0.02mm because the greater thickness would affect the welding quality of module board and interface board.

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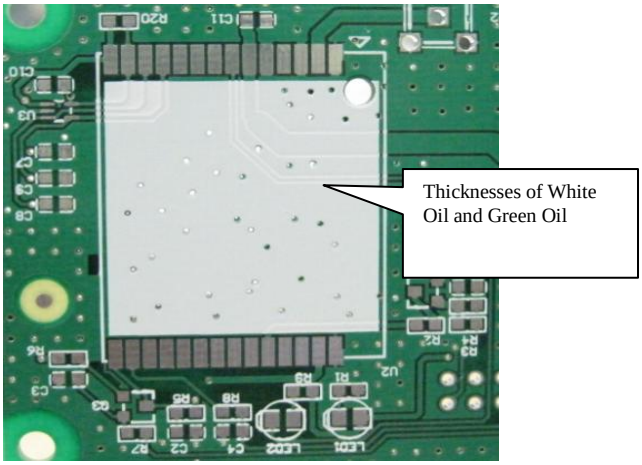
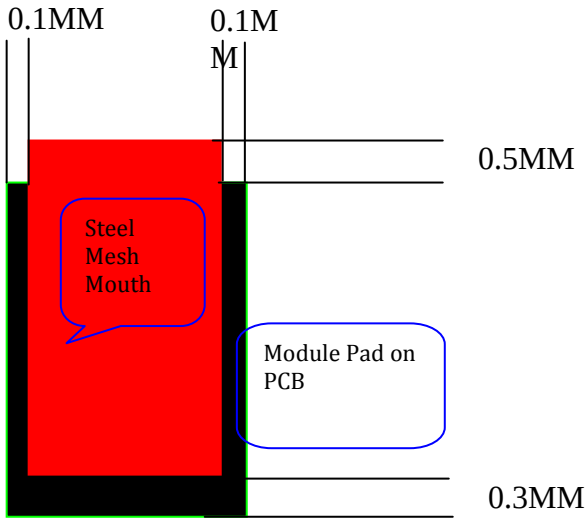



(The diagram is just for your reference; it does not represent the actual module encapsulation)

In addition, other components cannot be arranged within 2mm around the module on the interface board to ensure the maintenance of the module.

### 6.1.4 Design of steel mesh aperture at the module board's pad on the interface board

The thickness of the steel mesh on the interface board is selected based on the principle of comprehensive consideration according to the encapsulation type of components on the interface board. The expected thickness of steel mesh at the module on the interface board is 0.15mm (locally increased to 0.18MM at the module position), or just 0.18mm. In respect of the steel mesh aperture, the inner side of the pad is cut by 0.3mm, the two sides are respectively cut by 0.1mm, and the outside is extended by 0.5mm.




### 6.1.5 Module Board's Mounting

The pallets, which are suitable for mounting, have been made for many modules. If our company has offered the pallets, customers can directly apply them in Pick & placement machine; otherwise, customers need make a loading tool similar to the pallet. Customers can take out the modules from

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the packaging box, put them into the pallet according to the sequence and direction, and then start mounting.

Loading pallet

Mounting Pressure: In order to ensure a good contact between the module and the tin of the interface board, and the convenient welding, the pressure of placing the module board on the interface board is 2-5N according to our experiences. Different modules have different numbers of pads, therefore the pressure selected are different. Customers can select proper pressure based on their own situations.

### 6.1.6 Furnace Temperature Curve

As for the furnace temperature curve of module, we recommend that the peak temperature should be about 240~245°C. The time of the temperature above 217°C is 30~60 seconds. Besides, the temperature at the preheating area is kept at 150~200°C, and the time is 60~120 seconds.

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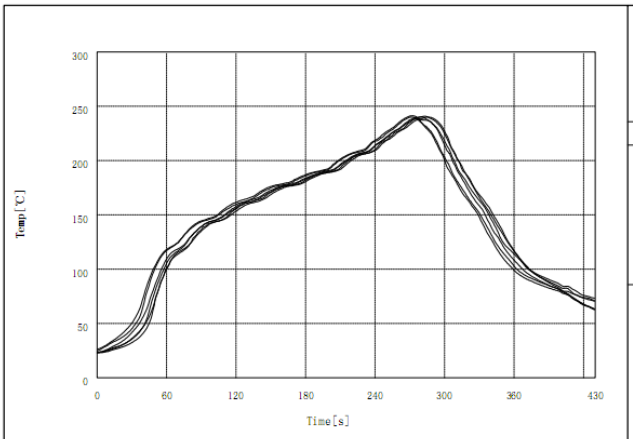
Title

TAM-6 Profile data




Ach: CPU底部(上面)　Dch: flash底部(上面)
Bch: 电容(上面)　Ech: 电阻(上面)
Cch: 排插底部(上面)　Fch: CPU底部(上面)

装置设定

| | |
|---|---|
| 装置名称 | 1800EXL |
| 传送速度 | 0.600m/min |
| O2浓度 | ppm |
| 温区数 | 8 |
| 全长 | 4000mm |

| 温区 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 上面[℃] | 145 | 155 | 170 | 185 | 195 | 215 | 240 | 247 |
| 下面[℃] | 145 | 155 | 170 | 185 | 195 | 215 | 240 | 247 |
| 长度[mm] | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| 风扇[Hz] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| 判定 | 范围 | 条件 | Ach | Bch | Cch | Dch | Ech | Fch | 基板设定 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 预加热时间[s] | 150-200[℃] | 60-120 | 104.5 | 104.0 | 103.0 | 104.0 | 104.5 | 103.0 | 文件名 | MC2270MK(M705-GRN3 |
| 超温时间1[s] | 217[℃] | 30-60 | 53.5 | 54.5 | 56.0 | 55.0 | 56.0 | 57.0 | 测定日 | 2011-03-08 15:36 |
| 超温时间2[s] | 230[℃] | 15-40 | 31.0 | 28.5 | 32.0 | 28.5 | 31.0 | 31.5 | 测定者 | 高新宇 |
| 超温时间3[s] | 245[℃] | 0-0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 基板名称 | ZTE MC2270 模块板 |
| 超温时间4[s] | 245[℃] | 0-0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 基板号码 | 3(M705-GRN360)无铅 |
| 最高温度[℃] | - | 245 | 240.2 | 241.4 | 240.1 | 240.0 | 238.4 | 240.9 | 温度取样时间 | 0.50s |
| 平均温度斜率1[℃/s] | 20-150[℃] | 0.0-2.0 | 1.2 | 1.2 | 1.1 | 1.2 | 1.1 | 1.1 | 备考 | 审核： |
| 平均温度斜率2[℃/s] | 150-210[℃] | 0.0-2.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | | |
| 平均温度斜率3[℃/s] | 210-245[℃] | 0.0-2.0 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.7 | | 批准： |
| 冷却时间[s] | 245-217[℃] | 0-60 | 19.5 | 19.0 | 18.5 | 22.5 | 25.5 | 20.0 | | |
| 最大温度斜率[℃/s] | 120 After[s] | 0.0-5.0 | 1.6 | 1.4 | 1.5 | 1.4 | 1.3 | 1.8 | | |
| Delta T[℃] | - | below 10 | 1.2 | 0.0 | 1.3 | 1.4 | 3.0 | 0.5 | | |

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The furnace temperature test board must be a physical board mounted on the interface board, and there must be the testing wires at the module board.

### 6.1.7 Reflow Method

If the interface board used by customers is a double-sided board, it is recommended to mount the module board at the second time. In addition, it is preferable for the interface board to reflow on the mesh belt at the first mounting and the second mounting. If such failure is caused by any special reason, the fixture should be also used to reflow in order to avoid the deformation of PCB during the reflow process.

### 6.1.8 Maintenance of Returned Defects

If any poor welding occurs to the module board and the interface board, e.g., pseudo soldering of the module board and the interface board, the welder can directly use the soldering iron to repair welding according to the normal welding parameters of our company

## 6.2 Module's Baking Guide

The module must be baked prior to second reflow.

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### 6.2.1 Module's Baking Environment

The operators must wear dust-free finger cots and anti-static wrist strap under the lead-free and good static-resistant environment.

See the following environment requirements.

During the process of transportation, storage and disposal, you must conform to the IPC/JEDEC J-STD-033 standard.

### 6.2.2 Baking Devices and Operation Procedure

Baking device: any oven where the temperature can rise up to 125℃ or above.

Precautions regarding baking: during the baking process, the modules should be put in the high-temperature resistant pallet flatly and slightly to avoid the collisions and frictions between the modules. During the baking process, do not overlay the modules directly because it might cause damage to the module's chipset.

### 6.2.3 Parameter Settings of Baking Devices

Baking temperature: 125℃±5℃

Baking duration: 8 hours

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# 7. Mechanical dimensions

## 7.1 Appearance diagram

Figure 7-1 MG2639_V3 appearance diagram

- Dimensions (L×W×H)：30.0 × 25.0 × 3.0mm
- Weight: <6g

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## 7.2 Module's assembly diagram

See the module's assembly diagram in figure 7-2.

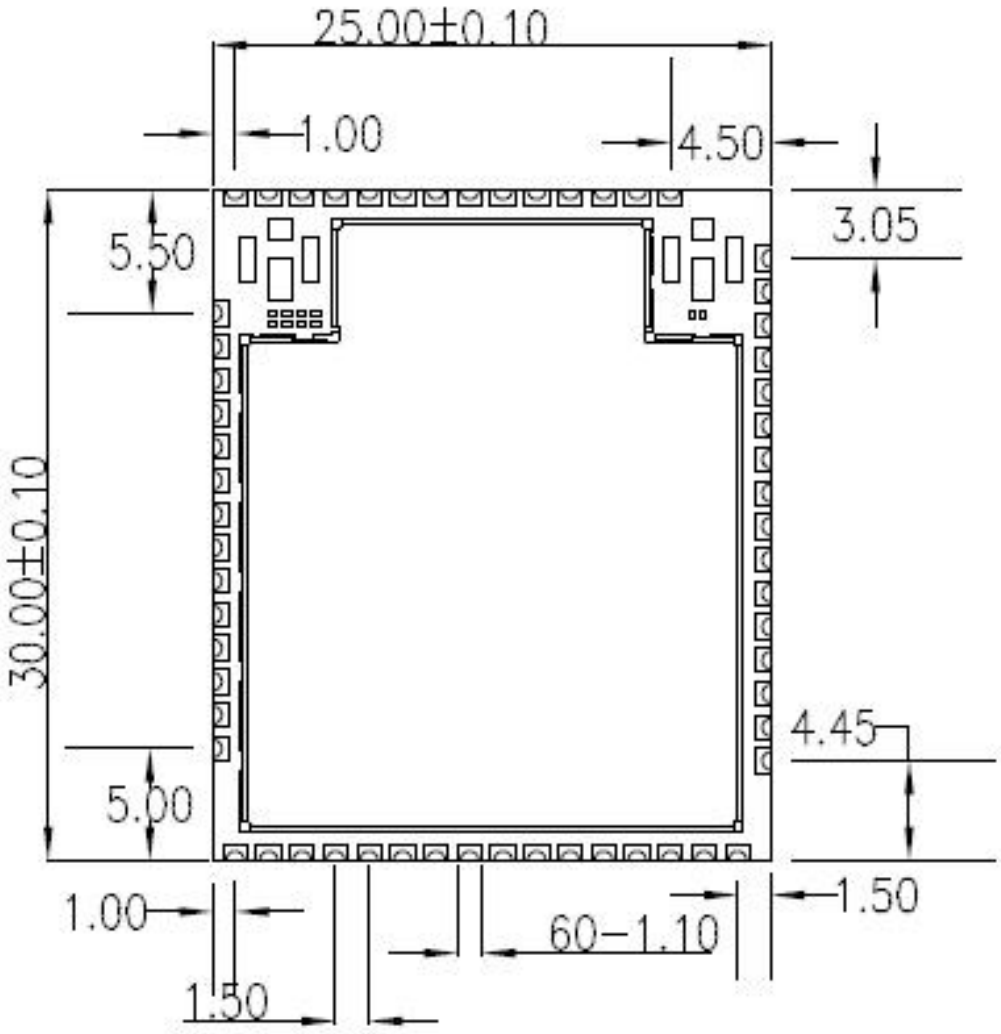


Figure 7-2 Module's assembly diagram

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## 7.3 Module's PCB package dimensions

See the module's PCB package dimensions in figure 7-3.

Figure 7-3 Relevant package dimensions from TOP view

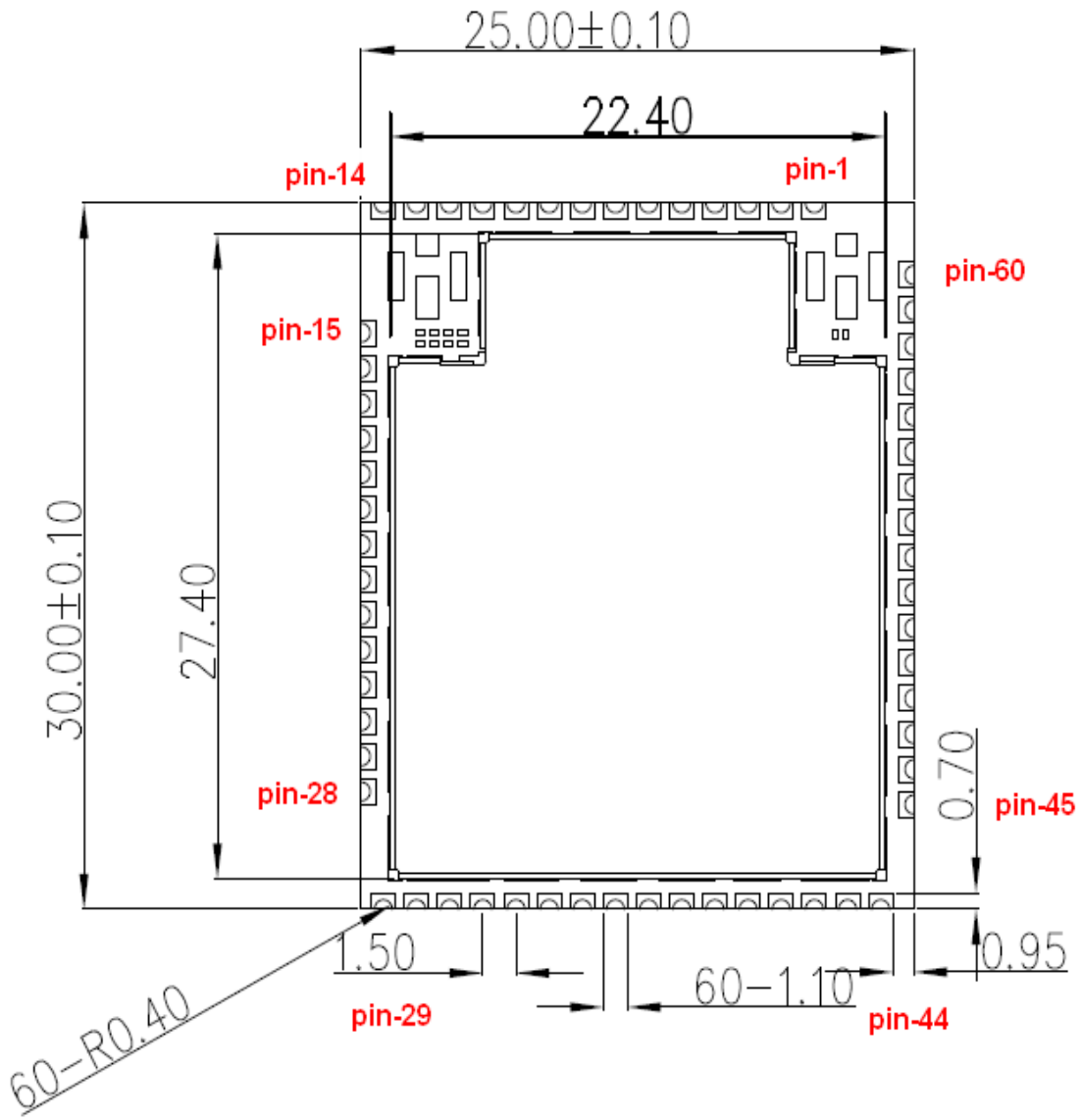


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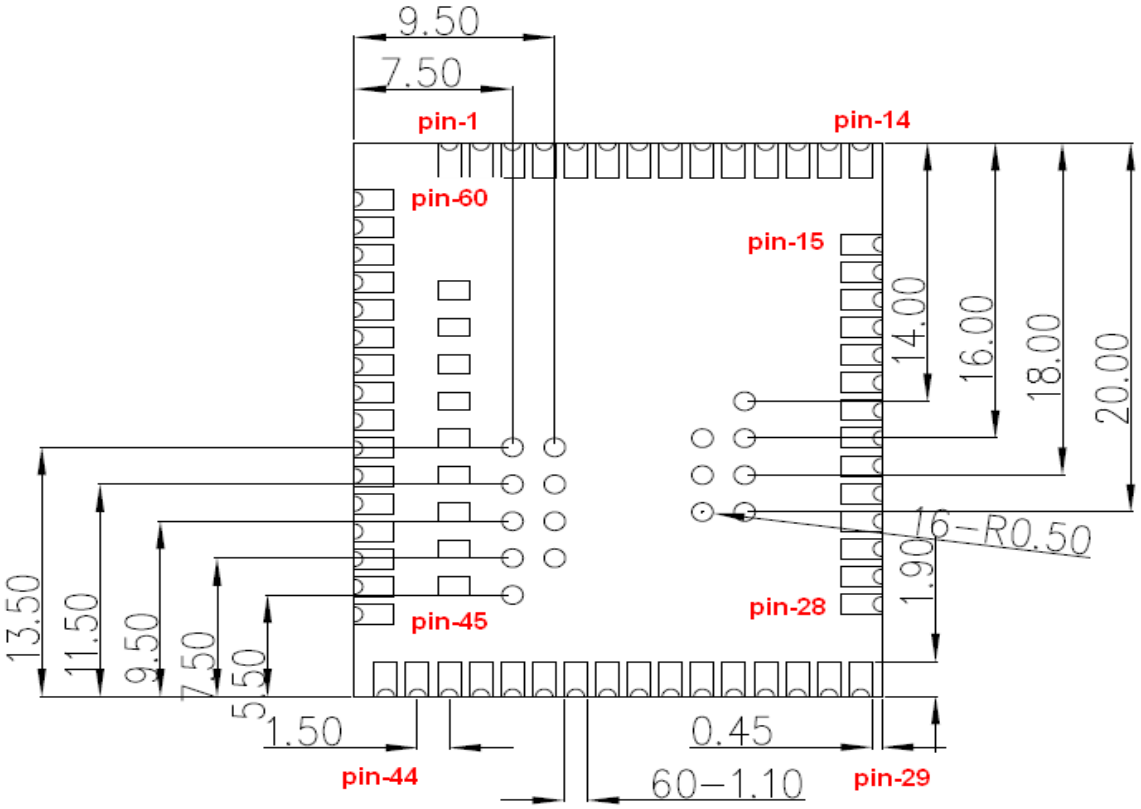
Figure 7-4 Relevant package dimensions from BOTTOM view

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